Notice No.5

Rules and Regulations for the Classification of Naval Ships, January 2017

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: December 2017

Amendments to	Effective date	IACs/IMO implementation (if applicable)
Volume 1, Part 1, Chapter 1, Sections 3 & 5	1 January 2018	N/A
Volume 1, Part 1, Chapter 2, Sections 1, 3 & 6	1 January 2018	N/A
Volume 1, Part 3, Chapter 3, Section 5	1 January 2018	N/A
Volume 1, Part 4, Chapter 3, Section 5	1 January 2018	N/A

Lloyd's
Register

Working together
for a safer world

Volume 1
Part 1, Chapter 1
General Regulations

■ *Section 3*
Technical Committee

3.1 ~~LR's Technical Committee is at present composed of a maximum of 80 members which includes:~~ LR maintains a Technical Committee, at present comprised of a maximum of 80 members, and additionally an Offshore Technical Committee with specific responsibility for LR's Rules for Offshore Units, at present comprised of a maximum of 80 members. Membership of the Technical Committees includes:

Ex officio members:

- Chairman and Chief Executive Officer of Lloyd's Register Group Limited
- Chairman of the Classification Committee of Lloyd's Register Group Limited

Members Nominated by:

- Technical Committee or Offshore Technical Committee
- Professional bodies representing technical disciplines relevant to the industry
- National and International trade associations with competence relevant to technical issues related to LR's business

3.2 In addition to the foregoing:

(a) Each National or Area Committee may appoint a representative to attend meetings of the Technical Committees.
(b) A maximum of five further representatives from National Administrations may be co-opted to serve on the Technical Committees. Representatives from National Administrations may also be elected as members of the Technical Committees as Nominated Members.
(c) Further persons may be co-opted to serve on the Technical Committees by the relevant Technical Committee.

3.3 All elections are subject to confirmation by the Board.

3.4 The function of the Technical Committees is to consider:

(a) any technical issues connected with LR's business;
(b) any proposed alterations in the existing Rules;
(c) any new Rules for classification;

Where changes to the Rules are necessitated by mandatory implementation of International Conventions and Codes, or Common Rules, Unified Requirements and Interpretations adopted by the International Association of Classification Societies, these may be implemented by LR without consideration by the relevant Technical Committee, although any such changes ~~will~~ may be provided to the Technical Committees for information.

Where changes to the Rules are required by LR to enable existing technical requirements within the Rules to be recognised as Class Notations or Descriptive Notes, these may be implemented by LR without consideration by the relevant Technical Committee, although any such changes will be provided to the relevant Technical Committee for information.

3.5 The term of office of the Chairman and of all members of ~~the~~ each Technical Committee is five years. Members may be re-elected to serve an additional term of office with the approval of the Board. The term of office of the Chairman may be extended with the approval of the Board.

3.6 In the case of continuous non-attendance of a member, the relevant Technical Committee may withdraw membership.

3.7 Meetings of the Technical Committees are convened as often and at such times and places as is necessary, but there is to be at least one meeting in each year. ~~Urgent matters~~ Matters may also be considered by the Technical Committees by correspondence.

3.8 Any proposal involving any alteration in, or addition to the General Regulations, of Rules for Classification is subject to approval of the Board. All other proposals for additions to or alterations to the Rules for Classification other than the General Regulations, will following consideration and approval by the relevant Technical Committee either at a meeting of ~~the~~ that Technical Committee or by correspondence, be recommended to the Board for adoption.

3.9 The Technical Committees ~~is~~ are empowered to:

(a) appoint sub-Committees or panels; and
(b) co-opt to the Technical Committee, or to its sub-Committees or panels, representatives of any organisation or industry or private individuals for the purpose of considering any particular problem.

■ *Section 5*
Applicability of Classification Rules and Disclosure of Information

5.1 LR has the power to adopt, and publish as deemed necessary, Rules relating to classification and has (in relation thereto) provided the following:

(a) Except in the case of a special directive by the Board, no new Regulation or alteration to any existing Regulation relating to classification or to class notations is to be applied to existing ships.

(b) Except in the case of a special directive by the Board, or where changes necessitated by mandatory implementation of International Conventions, Codes or Unified Requirements adopted by the International Association of Classification Societies are concerned, no new Rule or alteration in any existing Rule is to be applied compulsorily after the date on which the contract between the ship builder and shipowner for construction of the ship has been signed, nor within six months of its adoption. The date of 'contract for construction' of a ship is the date on which the contract to build the ship is signed between the prospective shipowner and the ship builder. This date and the construction number (i.e. hull numbers) of all the vessels included in the contract are to be declared by the party applying for the assignment of class to a newbuilding. The date of 'contract for construction' of a series of sister ships, including specified optional ships for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective shipowner and the ship builder. In this section a 'series of sister ships' is a series of ships built to the same approved plans for classification purposes, under a single contract for construction. The optional ships will be considered part of the same series of sister ships if the option is exercised not later than 1 year after the contract to build the series was signed. If a contract for construction is later amended to include additional ships or additional options, the date of 'contract for construction' for such ships is the date on which the amendment to the contract is signed between the prospective shipowner and the ship builder. The amendment to the contract is to be considered as a 'new contract'. If a contract for construction is amended to change the ship type, the date of 'contract for construction' of this modified vessel, or vessels, is the date on which the revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder. Where it is desired to use existing approved ship or machinery plans for a new contract, written application is to be made to LR. Sister ships may have minor design alterations provided that such alterations do not affect matters related to classification, or if the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the ship builder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to LR for approval. Recognising the long time period that may occur between the initial design contract and the contract for construction for offshore units for fixed locations, the date determining effective classification requirements will be specially considered by LR in such cases.

(c) All reports of survey are to be made by surveyors authorised by members of the LR Group to survey and report (hereinafter referred to as 'the Surveyors') according to the form prescribed, and submitted for the consideration of the Classification Committee.

(d) Information contained in the reports of classification and statutory surveys will be made available to the relevant owner, National Administration, Port State Administration, P&I Club, hull underwriter and, if authorised in writing by that owner, to any other person or organisation.

(e) Notwithstanding the general duty of confidentiality owed by LR to its client in accordance with the LR Rules, LR clients hereby accept that, LR will participate in the IACS Early Warning System which requires each IACS member to provide its fellow IACS members and Associates with relevant technical information on serious hull structural and engineering systems failures, as defined in the IACS Early Warning System (but not including any drawings relating to the ship which may be the specific property of another party), to enable such useful information to be shared and utilised to facilitate the proper working of the IACS Early Warning System. LR will provide its client with written details of such information upon sending the same to IACS Members and Associates.

(f) Information relating to the status of classification and statutory surveys and suspensions/withdrawals of class together with any associated conditions of class will be made available as required by applicable legislation or court order.

(g) A Classification Executive consisting of senior members of LR's Classification Department staff shall carry out whatever duties that may be within the function of the Classification Committee that the Classification Committee assigns to it.

Volume 1
Part 1, Chapter 2
Classification Regulations

■ *Section 1*
Conditions for Classification

1.1 Framework of Classification

1.1.12 It is a requirement that, where the vessel has fitted, on board, lifting appliances which are considered by LR to be necessary for it to fulfil its Ship Type role (e.g. aircraft lifts on aircraft carriers, landing platform dock stern ramp), the lifting appliance(s) are to be designed, built and surveyed in accordance with LR's *Code for Lifting Appliances in a Marine Environment, July 2017* ~~(LAME)~~ and the notation **LA** is to be assigned.

Alternatively, where a vessel was classed by a recognised classification society other than LR, and is later transferred into class with LR and, where the vessel has fitted, on board, lifting appliances which are considered by LR to be necessary for it to fulfil its Ship Type role and the lifting appliance(s) have been designed, built and originally surveyed in accordance with the same society's requirements for lifting appliances the notation **LȦ** will be assigned.

~~This notation~~ These notations will be assigned in association with a Register of Lifting Appliances listing the appliances covered. The Register of Lifting Appliances is the responsibility of the Owner.

Elsewhere, classification of lifting appliances is optional and may be assigned at the request of the Owner on compliance with the appropriate requirements, *see Vol 1, Pt 1, Ch 2, 3.9 Machinery and Engineering Systems notations* ~~*3.9.1*~~ and *Vol 1, Pt 1, Ch 2, 3.10 Other notations*.

■ *Section 3*
Character of Classification and Class notations

3.5 Ship type notations

3.5.11 Lifting appliances designed and built in accordance with the lifting appliance requirements of a recognised classification society other than Lloyd's Register and later transferred into class with LR. In such cases, a new Register of Ship's Lifting Appliances & Cargo Handling Gear (LA.1) will be issued in accordance with LR's *Code for Lifting Appliances in a Marine Environment, July 2017*. *See also Vol 1, Pt 1, Ch 2, 1.1 Framework of Classification 1.1.12.*

3.8 Military Distinction notations

(Part only shown)

Table 2.3.1 Hull, Military and Other Class Notations

Mandatory Notations	
Ship Type	Service Area
See Vol 1, Pt 1, Ch 2, 3.5 Ship type notations Military Operations AIR Aircraft Operations **LA** or LȦ Lifting Appliances	*See Vol 1, Pt 1, Ch 2, 3.6 Service area notations*

3.9 Machinery and Engineering Systems notations

(Part only shown)

3.9.1 The following class notations are associated with the machinery construction and arrangement, and may be assigned:

[✠]LMC This notation will be assigned when the propelling arrangements, steering systems, pressure vessels and the electrical equipment for Mobility and/or Ship Type systems, *see Vol 2, Pt 1, Ch 1, 3 Engineering system designation*, have been constructed, installed and tested under LR's Special Survey and are in accordance with LR's Rules for Naval Ships. Other items of machinery for propulsion and electrical power generation including propulsion gearing arrangements and other auxiliary machinery for Mobility and/or Ship Type systems that are in compliance with LR Rules and supplied with the manufacturer's certificate will be acceptable under this notation. The system arrangements of propelling and auxiliary machinery are required to be appraised by LR, and found to be acceptable to LR. ~~*See*~~ This notation is assigned subject to the conditions in *Vol 1, Pt 1, Ch 2, 6.3 Survey and inspection 6.3.3* being complied with.

MCH This notation will be assigned when the propelling and other machinery for Mobility and/or Ship Type systems, *see Vol 2, Pt 1, Ch 1, 3 Engineering system designation*, has been installed and tested under LR's survey requirements and found to be acceptable to LR. Items of machinery and equipment for propelling and auxiliary machinery for Mobility and/or Ship Type systems supplied with the manufacturer's certificate will be acceptable under this class notation. The system arrangements of propelling and essential auxiliary machinery are required to be appraised by LR, and found to be acceptable to LR. ~~*See*~~ This notation is assigned subject to the conditions in *Vol 1, Pt 1, Ch 2, 6.3 Survey and inspection 6.3.4* being complied with.

3.10 Other notations

3.10.3 A Register of Lifting Appliances is to be maintained for all classed and certified lifting appliances, including, where fitted:
(a) Bow, side and stern doors serving as ramps and/or serving to provide watertight integrity of the ship.
(b) Vehicle ramps.
(c) Movable decks.
(d) Personnel Lifts
(e) Stores lifts.
(f) Mechanized cargo handling systems.
(g) Cranes.
(h) Davits.
(i) Overboard recovery davits.
(j) Replenishment at sea equipment.
(k) Engineers lifting arrangements.
(l) Eye plates and securing devices exceeding 2,5 tonnes.
(m) Miscellaneous lifting arrangements.
(n) Towed body attachments.

Lifting Appliances for handling explosives stores or munitions can be brought within the scope of the **LAP** (or **LA**) notation but the *Code for Lifting Appliances in a Marine Environment, July 2017* will need to be augmented with Naval Administration requirements.

Maintenance of the Register of Lifting Appliances is the responsibility of the Owner and should include all classed and certified lifting appliances. The **LA,** LȦ, **LAP** and/or **LAC** notations will be retained so long as the appliances are found upon examination by LR at the prescribed surveys to be maintained in accordance with the standard.

3.10.18 **ENV**. This notation will be assigned where the environmental protection arrangements demonstrate compliance with one or more characters as described in the Rules. Available characters include:

A	Anti-fouling coatings;
~~**BWT**~~	~~Ballast water treatment;~~
GW	Grey water and sewage;
IHM	Inventory of hazardous materials (ship recycling);
MRV	Monitoring, reporting and verification of carbon dioxide;
NOx-1, **NOx-2**, **NOx-3**	Emissions of nitrogen oxides;
OW	Oily water management;
P	Oil tanks in protected locations;
RS	Refrigeration ~~Systems~~ systems;
SOx	Emissions of sulphur oxides~~.~~;
UWN	Underwater noise.

■ *Section 6*
Classification of machinery with [✠]LMC or MCH notation

6.3 Survey and inspection

6.3.3 Acceptance of manufacturer's certificates for items of machinery for propulsion (including propulsion gearing with single input/output arrangements) and for electrical power generation and for other auxiliary machinery for essential services where the [✠] ~~LMC~~ **LMC** notation is to be assigned, is subject to the following conditions:
(a) The vessel is an NS3 ship, an NS(SR) ship, or an (NS(SSC) ship of less than 500 gross tonnage or is a ship of 500 gross tonnage or greater and is not required to comply with international conventions applicable to a ship with unrestricted service.
(b) The design and manufacture standards for all machinery and associated systems are the applicable LR Rules.
(c) The machinery and equipment are manufactured under a quality control system which is in accordance with a recognised National or International Standard for such systems that is acceptable to LR.
(d) Propellers, propulsion shafting and multiple input/output gearboxes are not included within the scope of propulsion arrangements for acceptance of a manufacturer's certificate.

■ *Section 5*

Fixed and steering nozzles, bow and stern thrust units, ducted propellers

~~5.1 General~~

~~5.1.1 The requirements for scantlings for fixed and steering nozzles are given, for guidance only, in *Vol 1, Pt 3, Ch 3, 5.2 Nozzle structure* to *Vol 1, Pt 3, Ch 3, 5.4 Ancillary items* and *Table 3.5.1 Nozzle construction requirements*.~~

~~5.1.2 The requirements, in general, apply to nozzles with a numeral not greater than 200, *see Vol 1, Pt 3, Ch 3, 5.1 General 5.1.2*. Nozzles exceeding this value will be specially considered.~~

~~5.2 Nozzle structure~~

~~5.2.1 For basic scantlings of the structure, see *Table 3.5.1 Nozzle construction requirements*, in association with *Figure 3.5.1 Fixed and steering nozzles.*~~

~~5.2.2 The shroud plating in way of the propeller tips is to be carried well forward and aft of this position, due allowance being made on steering nozzles for the rotation of the nozzle in relation to the propeller.~~

~~5.2.3 Fore and aft webs are to be fitted between the inner and outer skins of the nozzle. Both sides of the headbox and pintle support structure are to be connected to fore and aft webs of increased thickness. For thicknesses, *see Table 3.5.1 Nozzle construction requirements.*~~

~~5.2.4 The transverse strength of the nozzle is to be maintained by the fitting of ring webs. Two ring webs are to be fitted in nozzles not exceeding 2,5 m diameter. Nozzles between 2,5 and 3,0 m in diameter are generally to have two full ring webs and a half-depth web supporting the flare plating. The number of ring webs is to be increased as necessary on nozzles exceeding 3,0 m in diameter. Where ring webs are increased in thickness in way of the headbox and pintle support structure in accordance with *Table 3.5.1 Nozzle construction requirements*, the increased thickness is to be maintained to the adjacent fore and aft web.~~

~~5.2.5 Local stiffening is to be fitted in way of the top and bottom supports which are to be integrated with the webs and ring webs. Continuity of bending strength is to be maintained in these regions.~~

~~5.2.6 Fin plating thickness is tobe not less than the cone plating, and the fin is tobe adequately reinforced. Solid fins arebe not less than 25 mm thick.~~

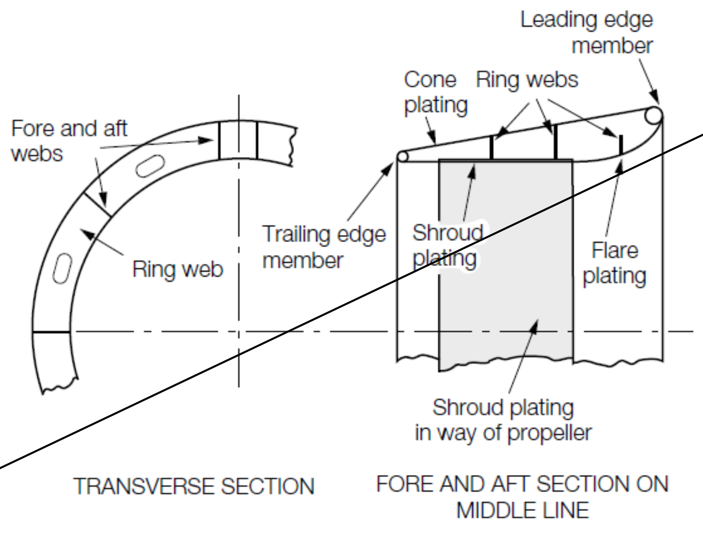

Figure 3.5.1 Fixed and steering nozzles

~~**Table 3.5.1 Nozzle construction requirements**~~

~~Item~~	~~Requirement~~
~~(1) Nozzle numeral~~	~~$N_N = 0{,}01Pd_p$~~
~~(2) Shroud plating in way of propeller blade tips~~	~~For $N_N \leq 63$~~ ~~$t_s = (11 + 0{,}1\ N_N)$ mm~~ ~~For $N_N > 63$~~ ~~$t_s = (14 + 0{,}052N_N)$ mm~~
~~(3) Shroud plating clear of blade tips, flare and cone plating, wall thickness of leading and trailing edge members~~	~~$t_p = (t_s - 7)$ mm but not less than 8 mm~~
~~(4) Webs and ring webs~~	~~As item (3) except in way of headbox and pintle support where $t_W = (t_s + 4)$ mm~~
~~(5) Nozzle stock~~	~~Combined stresses in stock at lower bearing $\leq 92{,}7$ N/mm^2~~ ~~Torsional stress in upper stock $\leq 62{,}0$ N/mm^2~~
~~(6) Solepiece and strut~~	~~Bending stresses not to exceed 70,0 N/mm^2~~
~~Symbols~~	
~~N_N = a numeral dependent on the nozzle requirements~~ ~~P = power transmitted to the propellers, in kW~~ ~~d_p = diameter of the propeller, in metres~~ ~~t_s = thickness of shroud plating in way of propeller tips, in mm~~ ~~t_p = thickness of plating, in mm~~ ~~t_W = thickness of webs and ring webs in way of headbox and pintle support, in mm~~	
~~Note Thicknesses given are for carbon steel. Reductions in thickness will be considered for certain stainless steels.~~	

~~5.2.7 Care is to be taken in the manufacture of the nozzle to ensure its internal preservation and watertightness. The preservation and testing are to be as required for rudders, see *Vol 1, Pt 6 Hull Construction in Steel.*~~

~~5.3 Nozzle stock and solepiece~~

~~5.3.1 Stresses, derived using the maximum side load on the nozzle and fin acting at the assumed centre of pressure, are not to exceed the values given in *Table 3.5.1 Nozzle construction requirements*, in both the ahead and astern conditions.~~

~~5.4 Ancillary items~~

~~5.4.1 The diameter of pintles and the diameter and first moment of area about the stock axis of coupling bolts are to be derived from *Vol 1, Pt 3, Ch 3, 2.16 Pintles* and *Vol 1, Pt 3, Ch 3, 2.13 Rudder stock flange couplings* respectively.~~

~~5.4.2 Suitable arrangements are to be provided to prevent the steering nozzle from lifting.~~

5.1 General

5.1.1 The requirements given in this Section are applicable to fixed and steering nozzles with an inner diameter of not greater than 5 metres.

5.1.2 For nozzles with an inner diameter greater than 5 metres, the maximum pressure acting on the nozzle is to be submitted by the designer. This pressure is to be used to determine the nozzle scantlings in accordance with the requirements of *Vol 1, Pt 3, Ch 3, 5.3 Nozzle scantlings* to *Vol 1, Pt 3, Ch 3, 5.5 Nozzle headbox*.

5.1.3 Suitable arrangements are to be provided to prevent the steering nozzle from lifting.

5.1.4 Effective means are to be provided for supporting the weight of the nozzle. The hull structure, in way of the nozzle supports, is to be suitably strengthened.

5.1.5 Care is to be taken in the manufacture of the nozzle to ensure its internal preservation and watertightness. The preservation and testing requirements are the same as for rudders, *see Vol 1, Pt 3, Ch 3, 2.11 Rudder blade* and *Vol 1, Pt 6, Ch 6, Table 6.6.1 Testing requirements*.

5.2 Design pressure

5.2.1 The design pressure for propeller nozzles, in kN/m^2, is to be determined as follows:

$$P_{\mathrm{d}} = c_{\mathrm{z}} P_{\mathrm{d0}}$$

$$P_{\mathrm{d0}} = \varepsilon c_{\mathrm{f}} \frac{N}{A_{\mathrm{p}}}$$

where

N is the maximum shaft power in kW

A_p is the propeller disc area, in m^2, taken equal to:

$$A_p = \frac{\pi \delta_p^2}{4}$$

δ_p is the propeller diameter in m

ε is a factor obtained from the following formula:

$$\varepsilon = 0{,}21 - 2 \times 10^{-4} \frac{N}{A_p}$$ but not to be taken less than 0,1

c_z is a coefficient taken equal to:

$c = 1{,}0$ in Zone 2 (propeller zone)

$c = 0{,}5$ in Zone 1

see also Figure 3.5.1 Nozzle construction

c_f is a coefficient taken equal to:

$c_f = 1{,}0$ for fixed nozzles

$c_f = 1{,}25$ for steering nozzles

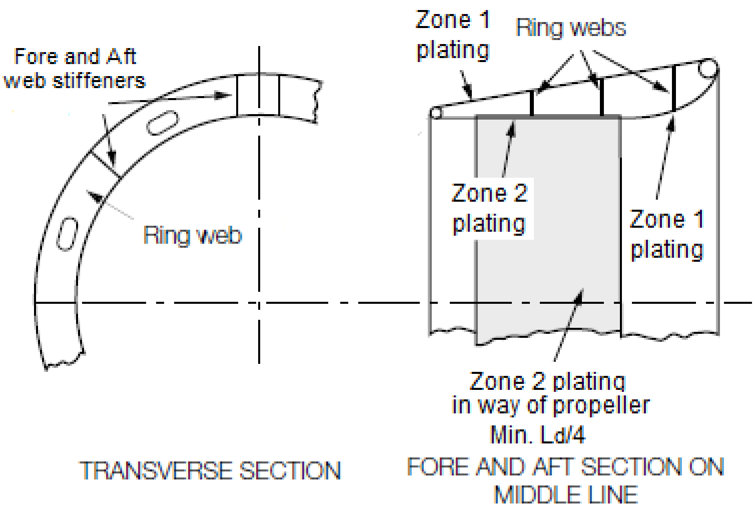

Figure 3.5.1 Nozzle construction

5.3 Nozzle scantlings

5.3.1 The scantlings of propeller nozzles are to be not less than required by *Table 3.5.1 Nozzle construction.*

Table 3.5.1 Nozzle construction

Item	Requirement
(1) Nozzle plating	$t = 5s\sqrt{P_d} + t_k$ but not less than 7,5 mm
(2) Ring webs and web stiffeners	Not less than the attached nozzle plating in way of Zone 1
(3) Webs in way of headbox and pintle support structure	$t_w = t + 4$ mm
(4) Section modulus of nozzle profile about its neutral axis	$Z = n\delta_p^2 L_d V^2$

Symbols

P_d = nozzle design pressure, *see Vol 1, Pt 3, Ch 3 5.2 Design pressures*
t = thickness of nozzle plating, in mm
t_w = thickness of web plating, in mm
s = spacing of web rings, in m
t_k = corrosion thickness, to be taken as:
  t_k = 2,5 in general
  t_k = 1,0 for stainless steel
δ_p = propeller diameter, in m
L_d = nozzle length, in m
n = coefficient taken equal to:
  n = 1,0 for steering nozzles
  n = 0,7 for fixed nozzle
V = maximum service speed in knots

5.3.2 The Zone 2 nozzle plating is to be carried well forward and aft of the propeller tips with due allowance being made on steering nozzles for the rotation of the nozzle in relation to the propeller, and is to extend at least 0,25 L_d in length.

5.3.3 Fore and aft web stiffeners are to be fitted between the inner and outer skins of the nozzle. Both sides of the headbox and pintle support structure, are to be connected to fore and aft webs of increased thickness.

5.3.4 The adjacent ring webs fore and aft of those connected to the headbox and pintle support structure are to be of a similar thickness to the ring webs connected to the headbox and pintle support structure.

5.3.5 Local stiffening is to be fitted in way of the top and bottom supports which are to be integrated with the web stiffeners and ring webs. Continuity of bending strength is to be maintained in these regions.

5.3.6 The plating thickness of attached fins is to be not less than the Zone 1 nozzle plating thickness and fins are to be adequately reinforced. Solid fins shall not be not less than 25 mm thick.

5.4 Nozzle stock and solepiece

5.4.1 The requirements for the nozzle stock are to be derived, in accordance with *Vol 1, Pt 3, Ch 3, 2.10 Rudder stock scantlings*, using the lateral nozzle force and maximum nozzle torque obtained in this sub-Section.

5.4.2 The nozzle stock is to be dimensioned such that the stresses do not exceed the permissible stress given in *Vol 1, Pt 3, Ch 3, Table 3.2.5 Rudder stock permissible stresses.*

5.4.3 The lateral nozzle force, C_{R}, at the centre of pressure is to be determined as follows:

$$C_{\mathrm{R}} = P_{\mathrm{d}} A_{\mathrm{t}} 10^3 \text{ N}$$

where

P_{d} = nozzle design pressure in zone 2, in kN/m^2

A_{t} = total projected area of nozzle and supporting structure, in m^2

$$A_{\mathrm{t}} = A_{\mathrm{n}} + A_{\mathrm{f}} + A_{\mathrm{s}}$$

where

A_{n} = projected area of nozzle, in m^2, to be taken as $1{,}57\delta_{\mathrm{p}} L_{\mathrm{d}}$

A_{f} = projected area of nozzle flap, in m^2

A_{s} = projected area of support structure in the longitudinal plane, in m^2

where δ_{p} and L_{d} are defined in *Table 3.5.1 Nozzle construction.*

5.4.4 The maximum nozzle torque, Q_{R}, is to be determined as follows:

$$Q_{\mathrm{R}} = C_{\mathrm{r}} \times r \text{ Nm}$$

where

r = distance from the centre of pressure to the stock, in m, to be taken as:

$$c(\alpha - k_1)$$

c = nozzle length plus the length of the nozzle flap if present.

α = relative centre of pressure along the nozzle length, to be taken as:

$\alpha = 0{,}25$ for fixed nozzles

$\alpha = 0{,}33$ for steering nozzles

k_1 = ratio of the nozzle area forward of the stock centreline to the combined area of the nozzle and flap

$$k_1 = \frac{A_1}{A_{\mathrm{n}} + A_{\mathrm{f}}}$$

A_1 is the portion of the nozzle area located forward of the stock centreline, *see also Figure 3.5.2 Nozzle geometry*

C_R , A_n and A_f are given in *Vol 1, Pt 3, Ch 3, 5.4 Nozzle stock and solepiece 5.4.2*

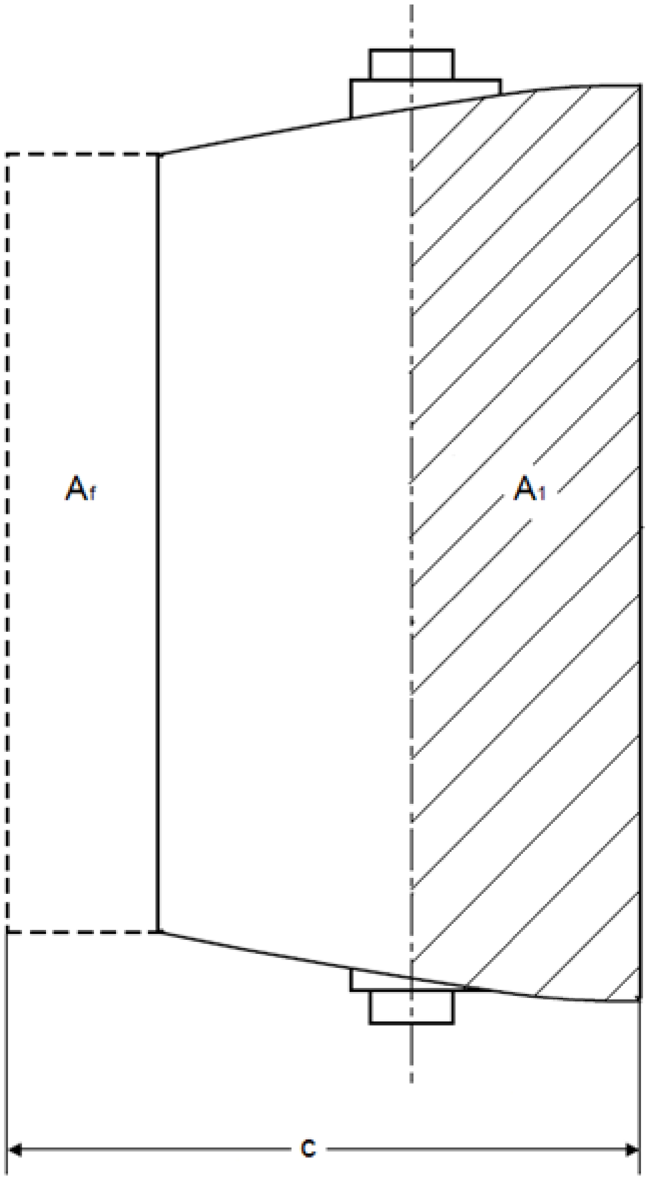

Figure 3.5.2 Nozzle geometry

5.4.5 The solepiece is to be assessed using direct calculation. Bending stresses, derived using the lateral nozzle force calculated in accordance with *Vol 1, Pt 3, Ch 3, 5.4 Nozzle stock and solepiece 5.4.3*, are not to exceed 70 N/mm^2.

5.5 Nozzle headbox

5.5.1 The section modulus of the headbox, Z, about the longitudinal axis is to be not less than:

$$Z = 0{,}143 P_d A_t D_H \times 10^2 \text{ cm}^3$$

where

P_d = nozzle design pressure in zone 2, in kN/m^2

$$D_H = \delta_h + \frac{\delta_p}{2}$$

where

δ_h = depth of headbox, in m

δ_p = propeller diameter, in m

A_t is given in *Vol 1, Pt 3, Ch 3, 5.4 Nozzle stock 5.4.2*

5.5.2 Plans detailing the integration of the headbox into the sternframe are to be submitted.

5.6 Ancillary items

5.6.1 Requirements for ancillary items such as bearings, couplings, pintles, etc. are given in *Vol 1, Pt 3, Ch 3, 2 Rudders.*

5.7 Welding

5.7.1 Double continuous welds are to be used as far as practicable for the connection between the inner and outer nozzle plating and the internal stiffening rings and webs. Slot welding is not permitted for the inner nozzle plating.

5.7.2 Additional welding requirements are given in *Vol 1, Pt 3, Ch 3, 2.4 Welding and design details*.

Existing sub-Sections 5.5 to 5.7 have been renumbered 5.8 to 5.10.

~~5.8~~ 5.11 Propeller ducting

~~5.8.1~~ 5.11.1 Where propellers are fitted within integral ducts/tunnels, the plating thickness in way of the blades is to be increased by 50 per cent.

~~5.8.2~~ 5.11.2 The tunnel wall in way of the propeller blades is to be additionally stiffened.

Existing sub-Sections 5.9 and 5.10 have been renumbered 5.12 to 5.13.

Volume 1
Part 4, Chapter 3
Special Features

■ *Section 5*
Movable decks, lifts, internal and external ramps

5.1 Classification

5.1.1 Where required by the **LA** or **LȦ** Notation, *see Vol 1, Pt 1, Ch 2, 1.1 Framework of Classification 1.1.12*, or specified by the Owner, movable decks will be included as a classification item. In such cases, all movable decks on board the ship are to comply with the requirements of this Section.

© Lloyd’s Register Group Limited 2017
Published by Lloyd’s Register Group Limited
Registered office (Reg. no. 08126909)
71 Fenchurch Street, London, EC3M 4BS
United Kingdom

Lloyd’s Register and variants of it are trading names of Lloyd’s Register Group Limited, its subsidiaries and affiliates. For further details please see http://www.lr.org/entities

Lloyd's Register Group Limited, its subsidiaries and affiliates and their respective officers, employees or agents are, individually and collectively, referred to in this clause as ‘Lloyd's Register’. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.